ABSTRACT

A frequency offset is estimated between at least one carrier frequency of at least one transmitter and a local reference frequency of a receiver. Received signals are processed using the local frequency reference oscillator to obtain representative complex numerical samples

5 which are correlated with shifts of a locally generated despreading code to produce a number of complex channel estimates, each corresponding to a different delayed ray of the multipath propagation channel. A frequency error estimate is computed for each ray based on successive values of a respective one of the channel estimates. A weighted summation is formed of the frequency error estimates to provide a relative frequency error estimate to control the local

10 frequency reference. The frequency error estimate may be computed by multiplying the current value of the respective channel estimate with the complex conjugate of a previous value of the same channel estimate and using the product as the frequency error estimate for the respective ray. An outer loop integrator may be used for integrating the frequency estimates to produce the control signal for controlling the local frequency reference. Alternately, frequency errors

15 computed on each of the despread value streams are corrected by progressively rotating the phase angle of successive despread values at a rate given by an associated frequency error integral, the frequency-corrected despread value streams are processed to produce complex channel estimates for each ray, the residual frequency error for each ray is determined by processing successive values of the channel estimates for the corresponding ray, and the

20 frequency error estimates are combined to produce the control signal. Inner loop integrators may be used for integrating respective residual frequency error values to produce frequency error integrals. Alternately, an inner loop integrator may be used for integrating the frequency error estimate to produce the inner loop integral values, and an outer loop integrator may be used for integrating the inner loop integral values to produce the control signal.